

# Job Demand-Control and Hypertension in African Americans and Non-African Americans

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**Objectives:** The aim of this study was to determine if occupational stress is a social determinant of elevated hypertension among African Americans. **Methods:** Currently employed, full-time adults from the Midlife in the United States Refresher and Midlife in the United States Milwaukee Refresher studies reported data on demographics, job characteristics, and medical history. **Results:** African American workers reported less job control and greater physical job demands than non-African Americans. Both physical and psychological job demands were independently associated with greater odds of high blood pressure. Job strain was associated with high blood pressure and differed by race ( $P < 0.05$ ). **Conclusions:** The elements of the job-demand control model differed by race and were most relevant for African Americans when exposed to high job demands and low job control. However, there was no evidence of differential vulnerability for either psychological demands, control, or physical demands for African Americans.

**Keywords:** high blood pressure, hypertension, job control, job demands, job strain, physical job demands

Hypertension affects 116 million or one out of every two Americans,<sup>1</sup> but it is not evenly shared in the population.<sup>2–5</sup> There is a twofold difference in rates of hypertension among adults who are non-Hispanic Black or African American (hereafter referred to as African American) relative to non-Hispanic White adults.<sup>6</sup> Moreover, African Americans develop hypertension at a younger age compared with non-Hispanic Whites.<sup>7,8</sup> The elevated experience of hypertension among African Americans is problematic in itself, but the problem is compounded because hypertension is a major risk for subsequent morbidities such as stroke, coronary heart disease, and chronic kidney disease.<sup>3</sup> Therefore, resolving racial differences in hypertension is a critical linchpin for achieving health equity.

A substantial body of research suggests that occupational stress, especially that characterized as the combination of high levels of pressure or expectation but low levels of decision-making,<sup>9</sup> is a risk factor for hypertension.<sup>2,10,11</sup> Nevertheless, the contributions of occupational stress to the well-documented racial disparities in hypertension are ambiguous. Curtis and colleagues<sup>12</sup> found sparse evidence that any form of occupational stress—high pressure, low decision-making, and the combination of both—was associated with hypertension among African Americans. Although explanations exist for Curtis and colleagues'<sup>12</sup> findings, the critical point is that the broader literature remains silent about the role of occupational stressors in explaining elevated hypertension among African Americans.

Employment, or more colloquially “work,” is a social determinant of health. Work is the primary source of income for adults around the world, and income is among the primary indicators of socioeconomic status<sup>13,14</sup> and the well-described health inequalities it creates.<sup>15–17</sup>

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## CME Learning Objectives

After completing this enduring educational activity, the learner will be better able to:

- Evaluate the elements of the Job-Demand Control model with hypertension
- Outline and examine the relationship between African Americans and non-African Americans to determine if occupational stress is a social determinant of racial inequalities in hypertension
- Discuss the disparities of health disparities based on race and job stress

Beyond income, though, work is the single most concentrated element of human existence. Apart from sleep, adults spend more time “at work” than any other activity.<sup>18,19</sup> The typical person begins engaging in the workforce in their mid to late teens, enters it full time in their late teens or early 20s, and remains engaged in the workforce for an additional 30 to 40 years.<sup>18</sup> Within this day-in, day-out reality, individuals are exposed to myriads of opportunities, threats, benefits, and challenges. Some benefits are systematically allocated by “full-time” versus “part-time” work (eg, access to health insurance or retirement plans), some challenges such as shiftwork are built into some occupational sectors (eg, hospital-ity, healthcare) but are absent from others (eg, education). Work is densely packed with distinctive multidimensional facets of time (eg, shiftwork, full-time vs part-time), social prestige, physical exposures (eg, gunfire, infectious pathogens, ergonomically designed chairs), and occupational stress.<sup>18</sup> Each facet individually and collectively has the potential for creating, maintaining, and exaggerating health inequalities.

The goal of this article is to determine if occupational stress is a social determinant of racial inequalities in hypertension, particularly the elevated burden of hypertension experienced by African Americans. To achieve this goal, we tested fundamental propositions of the Job Demand-Control (JDC) model in national data enriched with an African American oversample.

## CONCEPTUAL AND EMPIRICAL BACKGROUND

Karasek's<sup>9</sup> JDC model holds a central position in the occupational stress literature. The JDC consists of three primary concepts. Job demands are psychological pressures imposed on workers by the work itself or the management systems governing it.<sup>20</sup> Job demands often manifest in discrete forms such as the intensity of the work pace, frequent interruptions at work, and conflicting or difficult tasks to combine.<sup>4</sup> Job control, also sometimes referred to as autonomy, reflects the extent to which workers are able to make decisions about their work and the ability to develop and practice intellectual skills at work.<sup>10</sup> Finally, the JDC model argues that job strain, or the combination of high psychological job demands with low job control, is particularly deleterious in creating health problems, including high blood pressure.<sup>20</sup>

There is now substantial literature supporting the value of the JDC model in understanding hypertension and other stress-related

chronic diseases. Babu and colleagues,<sup>2</sup> in a meta-analysis of nine observational studies, reported the odds of hypertension were 30% greater among workers with job strain relative to those without. Similarly, Landsbergis and colleagues<sup>21</sup> meta-analysis of 22 studies concluded that job strain was associated with higher levels of ambulatory blood pressure across the day. However, there is also evidence that the components of job strain, that is, variation in the levels of job control and demands, may have independent effects on blood pressure. In a study examining the exposure of high job demands and low job control among white-collar workers and its effect on uncontrolled hypertension, Lavigne-Robichaud et al<sup>4</sup> found that men and women in the highest tertile of psychological job demands had a higher prevalence of uncontrolled hypertension. Although typically overlooked, the JDC model also recognizes the potential threat of physical job demands, such as heavy physical exertion and maintaining awkward postures throughout the workday. Elevated exposure to physical job demands has been associated with poorer health-related quality of life among immigrant Latino farmworkers,<sup>22</sup> another minority group with high rates of hypertension.<sup>23</sup>

Despite decades of blood pressure-related research, there have been only a few studies applying the JDC model to the elevated rates of hypertension experienced by African Americans. The first study applied the JDC model to data from the Pitt County study of hypertension.<sup>12</sup> Curtis and colleagues<sup>12</sup> found little evidence that the JDC model was useful for understanding hypertension among African Americans. Consistent with the JDC model, Curtis and colleagues<sup>12</sup> reported that high levels of control at work were associated with decreased risk for hypertension. Anticipated associations of the level of demand, alone or in combination with control, with hypertension, were reported as null. The second study by Landsbergis and colleagues<sup>11</sup> used data from the Multi-Ethnic Study of Atherosclerosis and reported that lower levels of control were associated with an elevated risk of hypertension. Landsbergis and colleagues<sup>11</sup> did not apply the JDC model to racial inequalities in hypertension; however, their use of an ethnically diverse sample indicated the model may perform differently for alternative occupational groups and segments of the workforce. Apart from these two articles, we could locate no other studies wherein the researchers applied the JDC model or other theories of occupational stress to the problem of racial inequalities in hypertension.

Differential exposure and differential vulnerability are two concepts often used by researchers to study health inequalities.<sup>24,25</sup> Differential exposure argues that some groups of people are exposed to higher levels of health pathogens or have lower access to health resources by virtue of their age, gender, race, or otherwise.<sup>24,26</sup> As it is applied to the JDC model and racial inequalities in hypertension, the differential exposure position would argue that African Americans have elevated rates of hypertension because they have greater exposure to psychological and physical demands and less access to control in their jobs. Differential vulnerability argues that some groups of people are more vulnerable to exposures, even if equally exposed because of inherent susceptibility or the lack of resources for treating or accommodating those exposures.<sup>27,28</sup> As it is applied to the JDC and racial inequalities in hypertension, the differential vulnerability position argues that the deleterious effect of job demands, psychological or physical, for hypertension is elevated among African Americans, whereas the beneficial effects of control for hypertension are attenuated among African Americans.

The goal of this study is to determine if occupational stress is a social determinant of elevated hypertension among African Americans. To achieve this goal, we apply the differential exposure and vulnerability hypotheses to the JDC model, a leading model of occupational stress. Specifically, we hypothesize:

Hypothesis 1. Job control is lower among African Americans than non-African Americans, whereas psychological demand and physical demand are greater among African Americans than non-African Americans.

Hypothesis 2. Racial differences in hypertension are attenuated after accounting for racial differences in job control, psychological and physical demand, and job strain.

Hypothesis 3. Race modifies associations of job control, psychological and physical demand, and job strain with hypertension.

## METHODS

### Sample

Data for this study were taken from the Midlife in the United States (MIDUS) Refresher cohorts, which consisted of a national sample and an enriched sample of African Americans from Milwaukee. The national MIDUS Refresher sample (n = 3577) was designed to demographically match and replenish the original MIDUS cohort in terms of age (25 to 74 years), gender, and educational attainment. Like the original MIDUS, the Refresher data consisted of a 30-minute phone interview followed by two 50-page mailed, self-administered questionnaires. The survey data collected demographic, psychosocial, physical, and mental health information. The MIDUS Milwaukee Refresher sample (n = 508) was recruited between 2012 and 2013. The MIDUS Milwaukee Refresher survey data consisted of a 2.5-hour computer-assisted personal interview (CAPI) followed by a 45-page mailed, self-administered questionnaire.

Participants for the current study were taken from the MIDUS Refresher and Milwaukee Refresher samples (N = 4085) and then delimited using two criteria. First, the analytic sample was delimited to participants who completed the portion of the assessment focused on work and employment, which was the second self-administered survey questionnaire for MIDUS Refresher participants, and those in the Milwaukee Refresher who complete the CAPI interview. Second, the analytic sample was delimited to individuals who reported currently working at the time of completing the self-administered survey questionnaire (MIDUS Refresher) or CAPI interview (Milwaukee Refresher) (n = 1408). Missing data for household earnings and body mass index (BMI) (see below) were greatest (ie, 3.5% and 3.3%, respectively), whereas approximately 1% of the sample had item or scale missing data for any of the JDC model concepts. Only participants with complete data were forwarded to the analyses, resulting in a final sample of 1289 (n = 1112 from the MIDUS Refresher and n = 177 from the MIDUS Milwaukee Refresher).

### Measures

#### High Blood Pressure

High blood pressure was determined by a self-reported diagnosis of high blood pressure by a physician. Specifically, participants were asked in the telephone interview (national sample) or the CAPI interview (Milwaukee sample), “Has a doctor ever told you that you have or had high blood pressure?” Individuals who responded affirmatively were coded one as “having high blood pressure”; negative or unsure responses were coded zero as “not having high blood pressure.”

#### Job Characteristics

Job characteristics were assessed in the second of two simultaneously distributed self-administered survey questionnaires in the MIDUS Refresher, but through CAPI for the MIDUS Milwaukee Refresher. In both modes (ie, self-administered vs CAPI), all items used a five-choice Likert rating scale ranging from 1 (all of the time) to 5 (never). The internal consistency of the items for each variable was assessed via Cronbach  $\alpha$ .

#### Psychological Demand

Psychological demand was assessed using five items, such as “How often do you have to work very intensively—that is, you are very busy trying to get things done?” and “How often do different people or

groups at work demand things from you that you think are hard to combine?" Items were coded and subsequently averaged such that a higher score reflected greater perceived psychological demands;  $\alpha = 0.74$  and  $0.61$  for the MIDUS Refresher and Milwaukee Refresher, respectively. Notice the estimated internal consistency of the psychological demand items did not reach conventional levels of acceptability (ie,  $\alpha > 0.70$ ) in the Milwaukee Refresher cohort. Nevertheless, the scale was retained "as is" to allow direct comparison of its association with hypertension for both African Americans and non-African Americans.

### Job Control

Control was measured with nine items, such as "Thinking about your current job, how often does your work demand a high level of skill or expertise?" and "Thinking about your current job, how often do you have a choice in deciding how you do your tasks at work?" Items were coded and subsequently averaged such that a higher score reflected greater perceived job control,  $\alpha = 0.86$  and  $0.86$  for the MIDUS Refresher and Milwaukee Refresher, respectively.

### Physical Job Demand

Physical job demand was assessed using eight items, such as "How often, during your work shift, does your job require you to—use a lot of physical effort? Lift loads weighing 50 lb or greater? Stand for long periods of time?" Items were coded and subsequently averaged such that a higher level indicated greater amounts of perceived physical job demand,  $\alpha = 0.91$  and  $0.91$  for the MIDUS Refresher and Milwaukee Refresher, respectively.

### Job Strain

Gómez Ortiz and colleagues<sup>29</sup> compared seven distinct operational forms of job strain and found that two forms consistently contributed the most explained variance to health outcomes. The first form, characterized as a "quadrant approach" because it classifies job strain discretely in terms of having scores in the highest quartile of psychological demand and the lowest quartile of job control, consistently explained the most variance across all health outcomes. The second form, characterized by the multiplicative interaction of level of psychological demand and job control, consistently explained the second most variance across the health outcomes. The so-called "quadrant approach" is not appropriate for the current study because it depends on the observed levels of psychological demand and control, but we hypothesize these values will systematically vary by race. Therefore, this study selected the multiplicative interaction, wherein race-specific group means were used to create "centered" versions of each variable and then multiplied to operationalize job strain.

### Demographic Covariates

Race is a dichotomous variable coded such that African Americans received a value of one; all others were coded zero or non-African American. Additional demographic covariates were age (in years), gender, categorical education, personal income, total hours worked per week, and BMI. Gender was categorized as either male or female; nonbinary/other and transgender were not possible response options. For education, a participant's highest formal education level was indicated as GED, high school graduation, or less; some college; bachelor of arts or science degree; or graduate or professional degree. Personal income was determined by a numerical response to the question: "In the last calendar year, including pay from all of your jobs and income from other sources such as retirement, unemployment insurance, food stamps, and gifts from family and friends, how much was your pretax income?" Total hours per week were determined by summing the responses to the questions: "How many hours did you work for pay at your main job?" and "How many hours did you work for pay at any other job?" Body mass index was calculated by dividing participants' self-reported weight (mass) in kilograms by height in meters squared.

### Data Analysis

All data were harvested from the MIDUS Colectica, a public online database that contains research data collected during the MIDUS Refresher and Milwaukee Refresher studies. Identical variables from the MIDUS Refresher and Milwaukee Refresher studies were selected and merged into one data set. Statistical analyses were conducted on IBM Statistical Package for the Social Sciences 27 (IBM Corp, Armonk, NY).

A series of hierarchical binomial logistic regression analysis models wherein high blood pressure was the dependent variable were used to test hypotheses about the role of occupational stressors in racial inequalities in hypertension. The first model regressed high blood pressure in African American race controlling for age, gender, educational attainment, household earnings, BMI, and total hours worked per week. The second model added each JDC concept, as well as the job strain variable, to examine the effect each JDC concept had on high blood pressure odds. In the third and final model, multiplicative interaction terms of African American race with each JDC concept were added to test if the association of each concept with high blood pressure was different for individuals who were African American than non-African American.  $P < 0.05$  was considered statistically significant for all statistical analyses.

## RESULTS

The analytic sample is reflective of a midlife working sample, enriched with additional African American adults (Table 1). Participants'

**TABLE 1.** Race-Stratified Distribution of Participant Demographics (n = 1289)

Variable	Total	African American (n = 177)	Non-African American (n = 1112)	P
Age, mean (SD), y	46.06 (11.95)	43.13 (11.26)	46.40 (12.07)	<0.01
Gender, n (%)				<0.001
Male	680 (52.8%)	66 (37.3%)	614 (55.2%)	
Female	609 (47.3%)	111 (62.7%)	498 (44.8%)	
Education, n (%)				<0.001
High school or less	201 (15.6%)	41 (23.2%)	160 (14.4%)	
Some college	215 (16.7%)	45 (25.4%)	170 (15.3%)	
4-y College degree	515 (40.0%)	59 (33.3%)	456 (41.0%)	
Graduate degree	358 (27.8%)	32 (18.1%)	326 (29.3%)	
Marital status				<0.001
Married	840 (65.2%)	59 (33.3%)	781 (70.2%)	
Formerly married	224 (17.4%)	40 (22.6%)	184 (16.5%)	
Never married	225 (17.5%)	78 (44.1%)	147 (13.2%)	
Personal income, mean (SD)	\$99,597 (\$68,005)	\$66,377 (\$54,792)	\$104,884 (\$68,425)	<0.001
Total hours worked, mean (SD)	44.42 (12.32)	43.13 (11.26)	44.6 (12.48)	0.13

average age was 46.06 (SD, 11.95) years, with non-African Americans being slightly older than African Americans (46.4 and 43.1 years, respectively). The sample was predominantly male (52.8%), although the overrepresentation of males was greater in the non-African American (55.2%) than the African American (37.8%) subsamples. Non-African Americans were more highly educated, with 70.3% having completed at least a 4-year college degree as opposed to African Americans (51.4%). African Americans reported lower average incomes (\$66,377 vs \$104,884), and the reported marital status also differed by race, with more African Americans than non-African Americans reporting having never been married (44.1% vs 13.2%). The reported total hours worked per week did not differ significantly by race.

Clinical indicators and job characteristics systematically differed by race (Table 2). More than a third of African Americans (39%) had hypertension as opposed to 29% of non-African Americans ( $P < 0.001$ ). African Americans also reported a higher mean level of BMI as compared with Non-African Americans (32.01 vs 28.12, respectively), and the difference in means was statistically significant ( $P < 0.001$ ). Reported levels of perceived psychological job demands did not differ by race (3.06 vs 2.97, for non-African Americans and African Americans, respectively). African Americans had a lower perceived job control mean in comparison to non-African Americans (3.43 vs 3.65, respectively), a statistically significant difference ( $P < 0.001$ ). African Americans reported greater ( $P < 0.05$ ) perceived physical job demands than non-African Americans (2.76 vs 2.52, respectively).

There was little bivariate evidence that elements of the JDC model were associated with hypertension. Only perceived physical demand among non-African Americans had a small ( $r = 0.06$ ) but statistically significant association ( $P < 0.05$ ) with hypertension; no comparable association was observed among African Americans. Expected intercorrelations among the job characteristics are noted; greater perceived job control is associated with more perceived psychological demand ( $r = 0.16$ ) and less perceived physical demand ( $r = -0.11$ ) among non-African Americans. Among African Americans, the magnitude of these associations is similar; greater perceived job control is associated with more perceived psychological demand ( $r = 0.29$ ) and less perceived physical demand ( $r = -0.12$ ), although the latter association is not statistically significant.

### LOGISTIC REGRESSION RESULTS

Results from multivariate hierarchical logistic regression models of high blood pressure are presented in Table 3. Results indicate the odds of having high blood pressure are 43% higher for African Americans than non-African Americans, controlling for other sociodemographic (eg, age, gender, educational attainment) and clinical (ie, BMI) covariates (Table 3, model 1), but at a trending level of statistical signifi-

cance ( $P = 0.07$ ). In the second step of the model, job characteristics were added simultaneously, including the job strain variable, to reflect the multiplicative interaction of perceived control to perceived psychological demand (Table 3, model 2). The results of this model indicated that both perceived psychological and physical job demands were independently associated with hypertension. For every one-unit increase in perceived psychological job demand, the odds of having hypertension increased by 32%. Similarly, for every one-unit increase in perceived physical job demand, the odds of having high blood pressure increased by 17%. Neither perceived job control nor job strain was associated with hypertension in this sample. However, model 2 offers evidence of suppression effects; that is, after controlling for racial variation in job characteristics, the estimated odds ratio for race increased from 1.43 in model 1 to 1.47 and became statistically significant ( $P < 0.05$ ) in model 2.

In the last model, we test if the association of each element of the JDC with hypertension differs by race by adding interaction terms to the model (Table 3, model 3). None of the associations between individual elements of the JDC with hypertension differed by race. However, the association of job strain with hypertension did differ by race ( $P < 0.05$ ). Among non-African Americans, there is no evidence that the relative level of perceived psychological demand to perceived job control is associated with hypertension (Fig. 1). By contrast, among African Americans, under conditions of low perceived psychological demand, increases in perceived job control are associated with a greater probability of hypertension, whereas increases in perceived job control are associated with a lower probability of hypertension among conditions of perceived high demand. Further, model 3 offers additional evidence of suppression effects; that is, the estimated differential odds of hypertension by race, as indicated by the odds ratio, increased from 1.47 in model 2 to 1.59 in model 3.

### DISCUSSION

In this study, we applied the differential exposure and vulnerability hypotheses to Karasek's<sup>9</sup> JDC model with hypertension and examined if elements of this model (ie, job control, psychological job demands, and physical job demands) differed by race. However, these findings are perceptual, and whether they reflect objective control and demands is unclear.<sup>30</sup> Studies that use more objective indicators of these phenomena would be valuable in replicating the findings of our study. Our goal was to determine if occupational stress is a social determinant of racial inequalities in hypertension, especially in African Americans. The results of our study make several contributions to the current literature.

Simple bivariate comparisons partially supported the hypothesis that elements of the JDC vary by race. As hypothesized, we did find

**TABLE 2.** Race-Stratified Job Characteristics and Correlations Among Main Variables (n = 1289)

	Non-African American (n = 1112)					African American (n = 177)				
	Mean	SD	1	2	3	4	5	Mean	SD	
1. Psychological demand	3.06	0.63	—	0.29**	-0.08	0.05	-0.01	2.97	0.69	
2. Control	3.65	0.68	0.16**	—	-0.12	-0.07	0.02	3.43***	0.79	
3. Physical demand	2.52	0.98	0.06*	-0.11**	—	-0.08	0.05	2.76**	1.13	
4. Body mass index	28.12	6.35	-0.01	-0.07*	0.06	—	0.11	32.01***	7.83	
5. Hypertension	0.29	0.45	0.02	-0.03	0.06*	0.26**	—	0.39***	0.49	
Mean			3.05	3.62	2.56	28.65	0.30			
SD			0.64	0.70	1.01	6.70	0.46			

Below the diagonal reflects correlations for non-African American respondents. Above the diagonal reflects correlations for African American respondents. Independent-samples *t* tests were used to compare means for African American and non-African American individuals.

\* $P < 0.05$ .  
 \*\* $P < 0.01$ .  
 \*\*\* $P < 0.001$ .

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**TABLE 3.** Multivariate Hierarchical Logistic Regression Models of High Blood Pressure

Variable	Model 1			Model 2			Model 3		
	B	SE	Exp(B)	B	SE	Exp(B)	B	SE	Exp(B)
Race	0.36	0.19	1.43	0.38*	0.19	1.47	0.47*	0.20	1.59
Psychological job demands <sup>a</sup>				0.28*	0.11	1.32	0.35**	0.12	1.42
Job control <sup>a</sup>				-0.01	0.10	0.99	-0.01	0.11	0.99
Physical job demands <sup>a</sup>				0.16*	0.07	1.17	0.16*	0.08	1.18
Job strain <sup>b</sup>				0.03	0.14	1.03	0.18	0.16	1.20
Race interactions with									
Psychological job demands <sup>b</sup>							-0.37	0.29	0.69
Job control <sup>b</sup>							0.07	0.25	1.07
Physical job demands <sup>b</sup>							-0.03	0.17	0.97
Job strain <sup>b</sup>							-0.72*	0.36	0.49
Covariates									
Age	0.06***	0.01	1.06	0.06***	0.01	1.06	0.06***	0.01	1.06
Gender	-0.50***	0.14	0.61	-0.50***	0.14	0.61	-0.49***	0.14	0.61
Educational attainment									
High school, GED, or less	0.07	0.20	1.07	0.01	0.23	1.00	0.01	0.23	1.01
Some college	-0.05	0.22	0.95	-0.10	0.22	0.91	-0.11	0.22	0.90
College graduate	0.07	0.17	1.07	0.04	0.17	1.04	0.03	0.17	1.03
Graduate or professional degree		Reference			Reference			Reference	
Personal income <sup>c</sup>	-0.02	0.01	0.98	-0.01	0.01	0.99	-0.01	0.01	0.99
Body mass index	0.08***	0.01	1.08	0.08***	0.01	1.08	0.08***	0.01	1.09
Total hours worked/week	-0.01	0.01	0.99	-0.02*	0.01	0.99	-0.02**	0.01	0.98

\*P < 0.05.

\*\*P < 0.01.

\*\*\*P < 0.001.

<sup>a</sup>Variables are centered based on race group (ie, African American and non-African American).

<sup>b</sup>Interaction terms were created using racial group mean-centered variables.

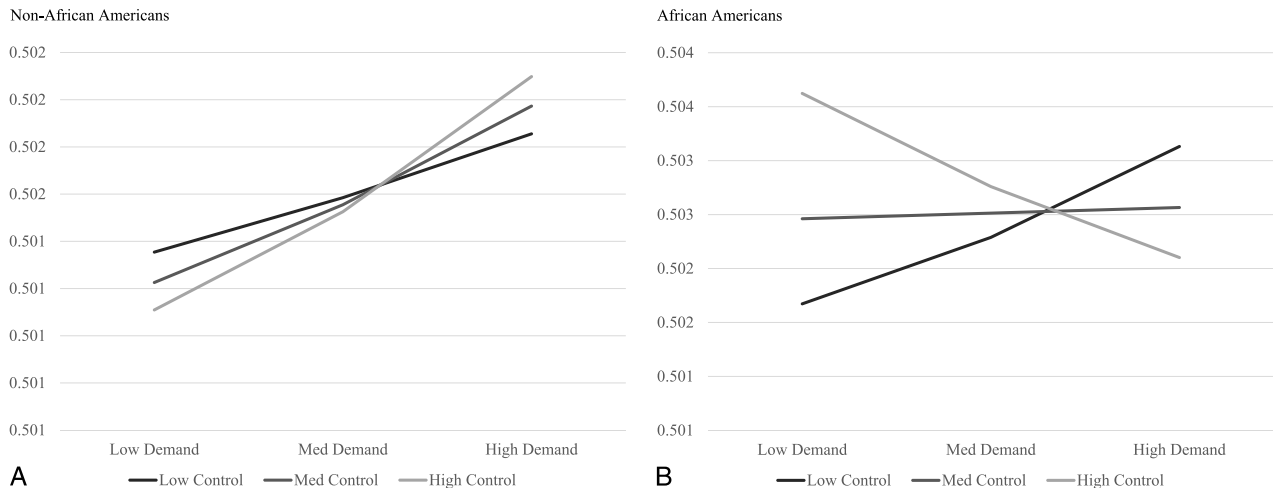
<sup>c</sup>Personal income was modeled in \$10,000 increments.

GED, General Educational Development.

that full-time African American workers reported less perceived control and greater perceived physical job demand than non-African Americans who were predominantly White. However, contrary to our hypothesis, African Americans and non-African Americans reported comparable perceived psychological demands. These results are consistent with those reported by Landsbergis and colleagues,<sup>31</sup> who showed that African Americans in the Multi-Ethnic Study of Atherosclerosis were systematically disadvantaged in several job stressor attributes related to health.

Results from multivariate logistical regression models contradicted the hypothesis that accounting for JDC elements would partially explain racial inequalities in high blood pressure (hypothesis 2). Contrary to the JDC, we found no evidence that perceived control or job

strain was associated with high blood pressure. However, both perceived psychological and physical demands were each independently associated with greater odds of reporting high blood pressure, which comports with the JDC model. Others have documented an association of perceived psychological demand with high blood pressure<sup>4,12</sup>; however, we believe this is the first study to demonstrate a comparable association of perceived physical demand with high blood pressure. Other research reported that perceived physical demand was the only JDC concept associated with health-related quality of life in immigrant Latino workers,<sup>22</sup> suggesting that physically demanding work may promote poor health through insufficient rest and recovery. These findings reinforce those of Curtis and colleagues<sup>12</sup> and others<sup>21</sup> who have suggested that the “blue-collar” (ie, more physical or manual)



**FIGURE 1.** Predicted probability of hypertension by job strain. A, Non-African Americans. B, African Americans.

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nature of work more often performed by African Americans may lend to hypertension risk. Central to the current analysis, though, there was no evidence that racial differences in high blood pressure were attenuated after accounting for racial variation in the JDC concepts.

Perhaps the most meaningful contribution of this study is evidence that the association of job strain, or the combination of perceived psychological demand and control, with high blood pressure differs by race. As shown in Figure 1, among non-African Americans, the predicted probability for high blood pressure remained constant across combinations of perceived psychological demand and control. However, for African Americans, the greatest predicted probability of high blood pressure was observed when perceived psychological demands were low, and perceived job control was high. It is noteworthy that perceived job control was not associated with hypertension and may even pose a risk for African Americans, although close inspection of the y axis indicates whatever differences exist by race, they are quantitatively modest (Fig. 1). Nevertheless, African Americans may be disproportionately found in jobs that limit their opportunity at a job control level comparable to non-African Americans (ie, blue-collar jobs).<sup>12,32</sup> Another possibility is that perceived job control may provide a benefit for non-African Americans by protecting them from physically demanding jobs, whereas similar protections are not evident for African Americans. Future research should consider these findings. Yet, under conditions of high perceived psychological demand, increases in perceived job control may protect against hypertension as the JDC model argues. This suggests that the theory of job strain only held for African Americans in this sample. Further, after accounting for the differential vulnerability of African Americans to job strain, there was clear evidence of suppression. That is, rather than the JDC explaining racial differences in high blood pressure, these data suggest that job strain in the African American community may cover or mask additional risk for hypertension.

The observed racial difference in the association of job strain with high blood pressure, although small in effect size, is worthy of comment. On the one hand, the results are inconsistent with those of Curtis et al,<sup>12</sup> who found that job strain was not predictive of hypertension in their predominantly African American population from Pitt County, NC. However, as Curtis and colleagues noted, employment options were constrained for African Americans in Pitt County, perhaps resulting in null associations because of the restricted range. The theoretically broader range of employment options by African Americans in the MIDUS Refresher may have generated the power needed to detect differences. It is also possible that our decision to operationalize job strain in the multiplicative form as opposed to other commonly used strategies<sup>29</sup> may have resulted in the novel association. Pragmatically, the multiplicative form of job strain was selected because we expected and found that elements of the JDC differed by race. Therefore, more traditional operational forms of job strain—like the highest quartile of perceived psychological demand and the lowest quartile of perceived control—would have been inappropriate because they mask substantive racial differences in the component elements. Measurement evaluation of JDC concepts across racial and ethnic groups along with conceptually informed meanings of different operational indicators of job strain<sup>29</sup> is needed to further understand the role of occupational stressors in health inequalities.

The contributions of our research must be considered considering its limitations. Foremost, this study is based on cross-sectional data, thereby impeding any ability to make causal inferences. Next, the MIDUS did not use the full battery of items from the Job Content Questionnaire,<sup>29</sup> which can produce meaningful variation in estimates of JDC concepts.<sup>29</sup> Our study focuses on the JDC model; however, we did not include the social support aspect of the model. Therefore, future research may want to include it to further test this model. Although the MIDUS used a national probability design, the oversampling of African Americans through the MIDUS Milwaukee Refresher may have produced an oversampling of blue-collar occupations, which could have contributed

to the observed association of perceived physical job demands with high blood pressure. The observed racial difference in the association of job strain with hypertension was small, albeit statistically significant. Further, the estimated standard errors obtained from the regression models are large relative to the observed associations (ie, >30%), suggesting possible instability. Finally, African Americans' generally lower rates of health care utilization relative to Whites<sup>5</sup> may have contributed to underestimated racial differences in high blood pressure because our measure was based on having ever been diagnosed by a physician.

Limitations notwithstanding, the results of this study contribute to a better understanding of the role occupational stressors may play in racial inequalities in hypertension. Results indicate that African Americans have less perceived control in the workplace and more perceived physical demands than predominantly White non-African Americans. Replication is needed, but the results of this study suggest that African Americans' generally lower levels of perceived control at work may mask the additional burden of high blood pressure, although achieving more perceived control has greater potential antihypertensive benefits relative to non-African Americans. Collectively, although additional longitudinal research is needed, the overall pattern of results suggests work is a social determinant of health that requires attention when seeking to understand health disparities.

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